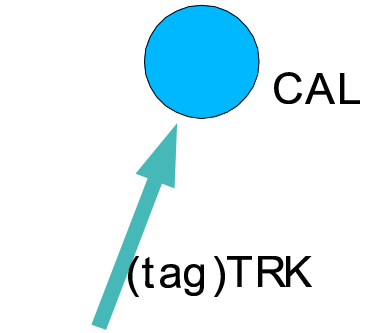
EM reco efficiencies vs jet multiplicity continued ...

Samples

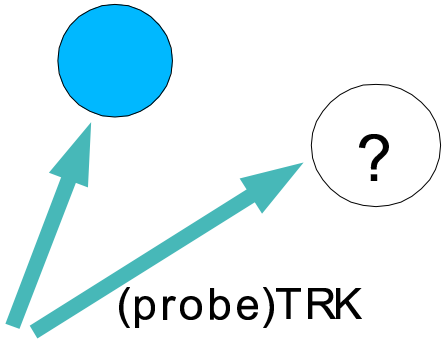
- **Data:**
  - EM1TRK skim
  - Single EM triggers
  - Run range: April 2002 till March 2004
  - Rejecting bad runs (CAL, SMT, CFT, Jet/Met, Lumi)
  - No t42 applied
  - Processed with ATHENA (v01-05-02)
- **MC:**
  - $Z/\gamma^{*} > e^{+}e^{-}$ inclusive
  - Pythia
  - 400k events
  - Request IDs: 12018, 12028, 12029, 12030
  - Processed with ATHENA (v01-05-02)

Tag & Probe Method

Tag:



Probe:



Z(ee) + n Jets Analysis Cuts:

PVX < 60cm

Tag-Electron: EMF > 0.9, Iso < 0.15, HMx7 < 12., p_T > 25 GeV, $|\eta|$ < 1.1, **with** phi cracks,
matched with a good track in $\Delta R(<0.14)$

Trigger: tag electron is required to have fired single electron trigger

Tag & ProbeTracks: 25 GeV < p_T < 80 GeV, Chi2 < 8.0, |DCA0| < 0.3, |DCA1| < 4.0, $|\eta|$ < 1.1, **with** phi cracks

Probe: Good track separated from Tag by $\Delta\Phi > 2.0$

Opposite sign track requirement to reduce background

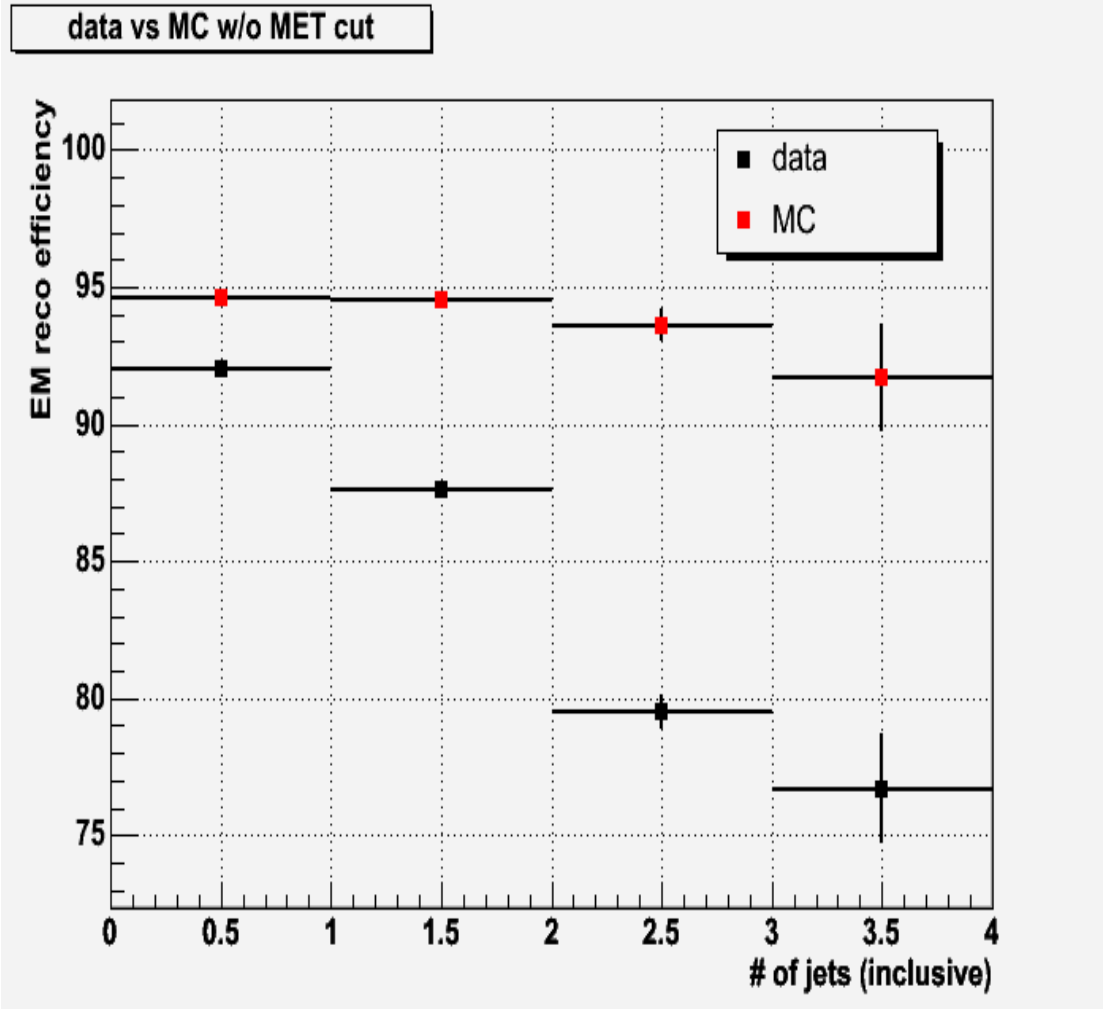
TagElec-ProbeTrack-invmass cut: 70 GeV < M_{ee} < 110 GeV

Reco matching cone: $dR = SQRT(\Delta\eta^2 + \Delta\Phi^2) = SQRT(.1^2+.1^2) = 0.14$

Jets: 0.05 < EMF < 0.95, HotF < 10.0, N90 > 1, CHF < 0.4, L1conf, p_T > 20., |eta| < 2.0, **not counting jets overlapping with probe tracks within $\Delta R < 0.4$**

EM reco efficiencies vs jet multiplicity in data and MC

These are the data and MC efficiencies based on the cuts from the previous slide:



2 main issues:

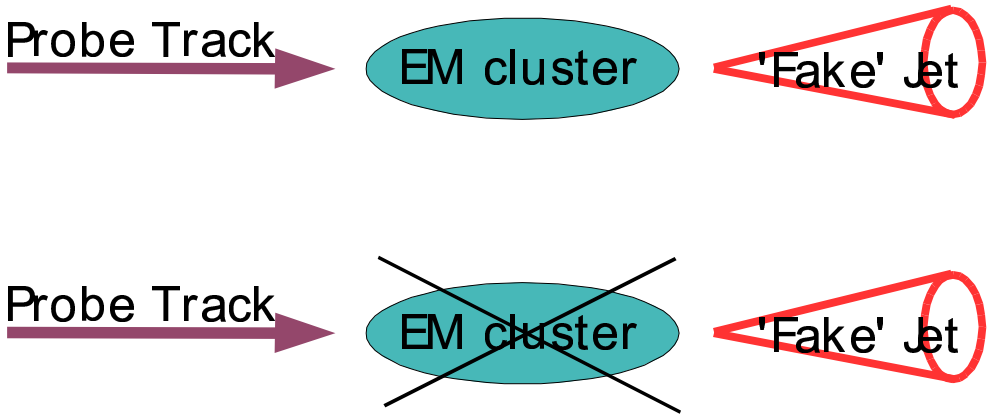
1. Gustavo Otero (top_analyze) observed steep drop in both MC **and** data.

2. Why do the data efficiencies drop so steeply in this analysis, whereas MC only drops slightly?

Issue 1: Comparing MC efficiencies with top_analyze

Different ways of removing 'fake' jets can lead to differences in the EM reco efficiencies vs jet multiplicity:

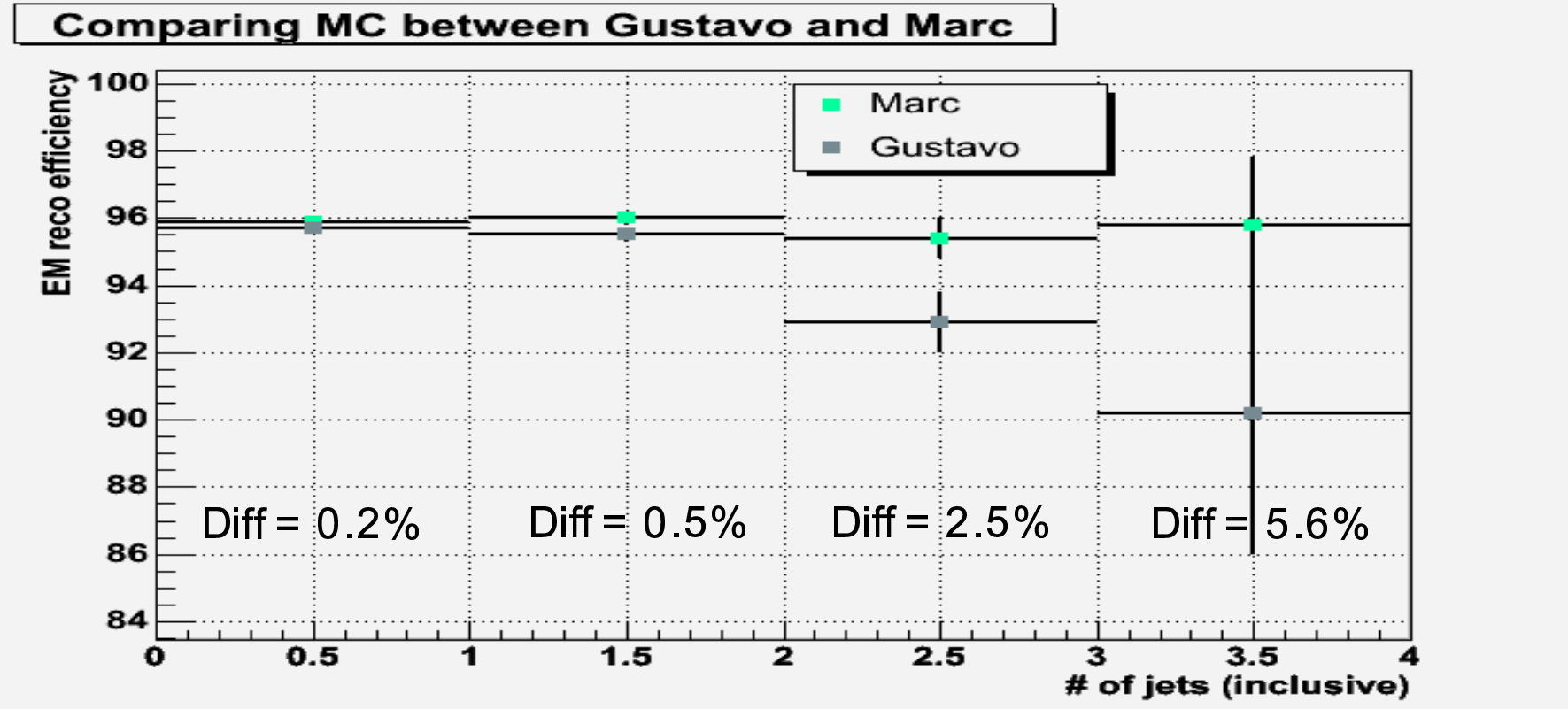
- Track-jet removal (this analysis):
  removes all jets that overlap with tag-/probe-tracks
- EM-jet removal (top_analyze):
  removes all jets that overlap with reconstructed EM clusters (passing 'loose' quality cuts: $p_T > 15$ GeV, $|eta_{Det}|<2.5$, EMF>0.9, Iso<0.15)



	Trk-jet removal	EM-jet removal
Probe Track → EM cluster, 'Fake' Jet	removes jet	removes/keeps jet (depending on wether or not EM cluster passes 'loose' cuts)
Probe Track → EM cluster (crossed out), 'Fake' Jet	removes jet	keeps jet

Comparing MC efficiencies with top_analyze

After trying to get the two methods as close as possible (using track-jet removal and similar quality cuts, including a cut on MET) this is how the comparison looks like:



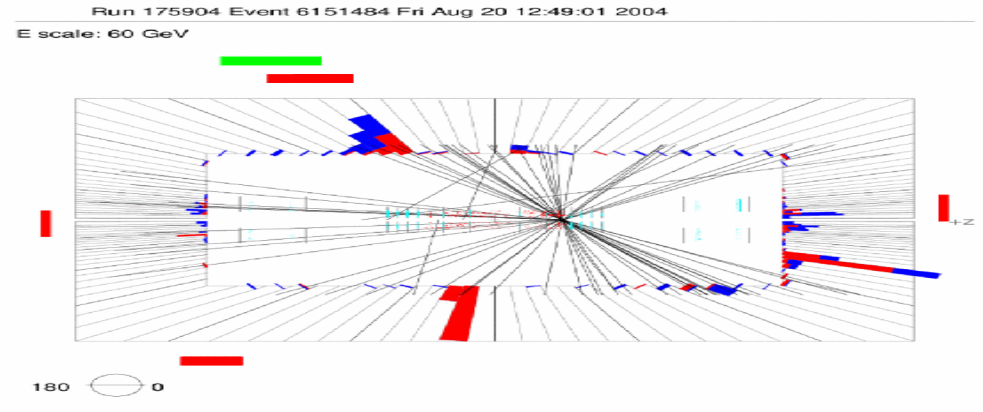
Much better aggreement now.

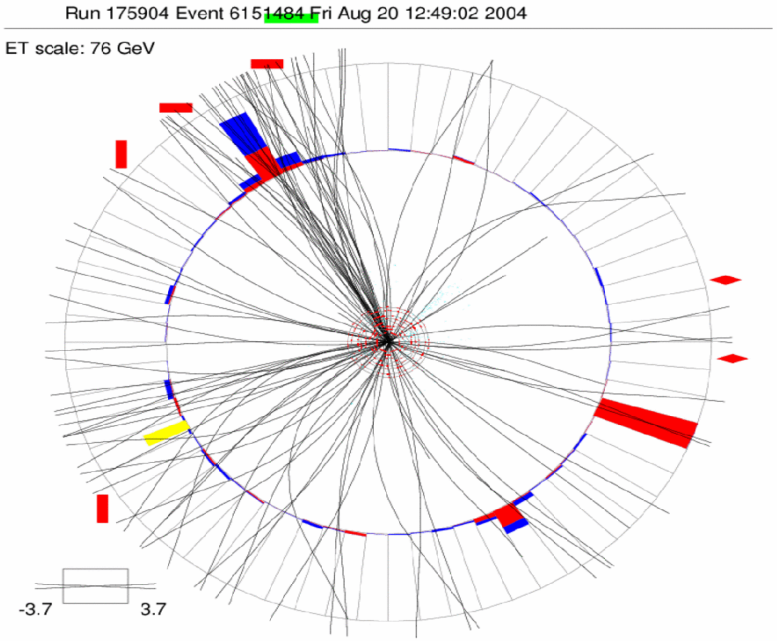
Residual differences still need to be understood.

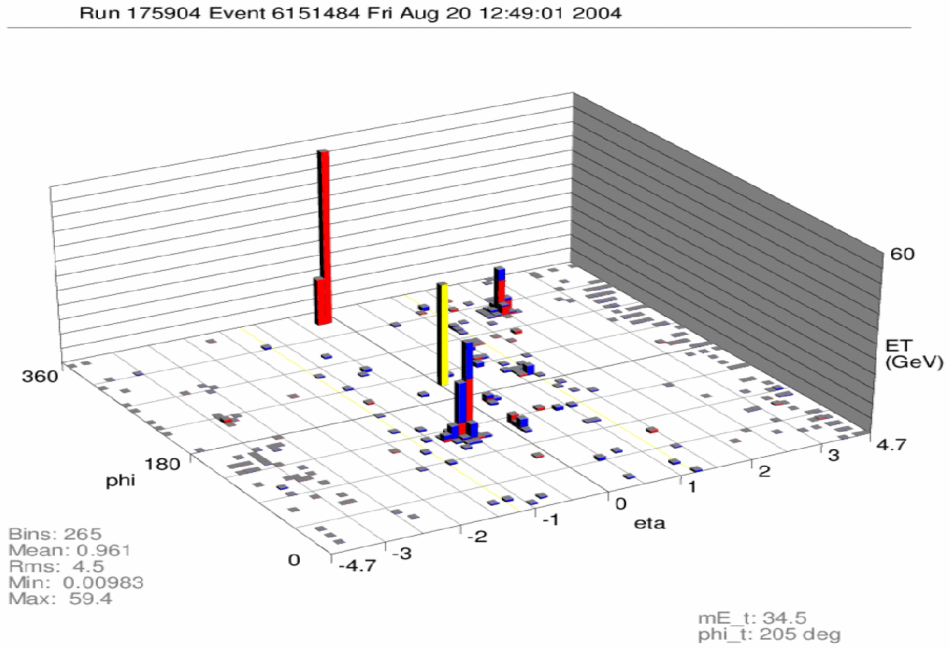
Issue 2: Why does data drop so steeply?

Could it be due to background ?

Typical event display for inefficient event:

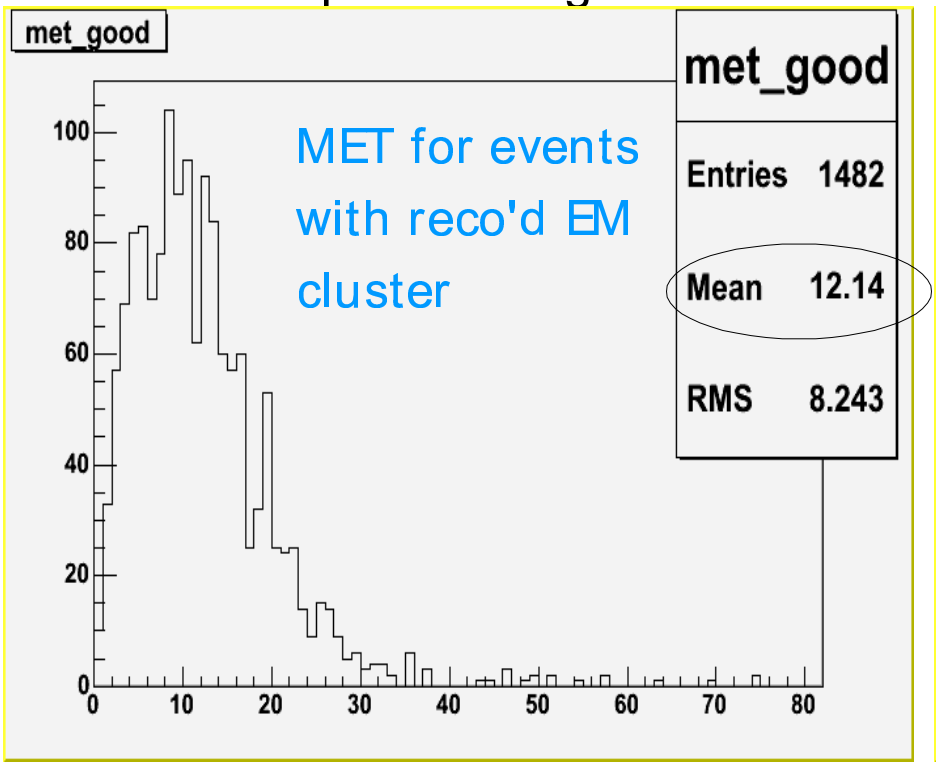


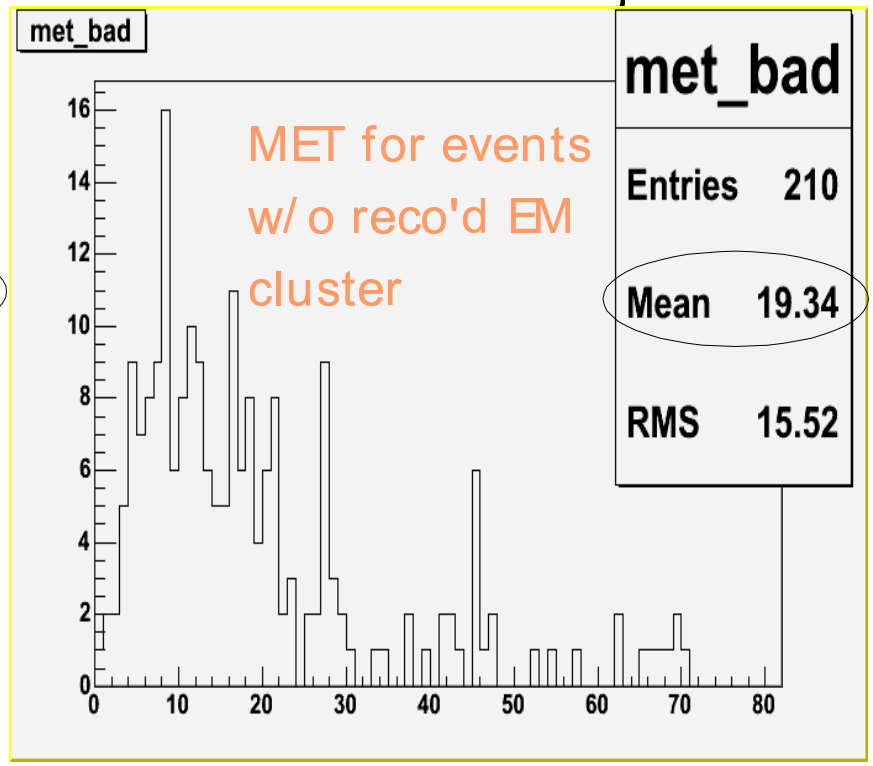




Looking at MET

As an example: looking at the MET distributions in data for # of jets >= 1:

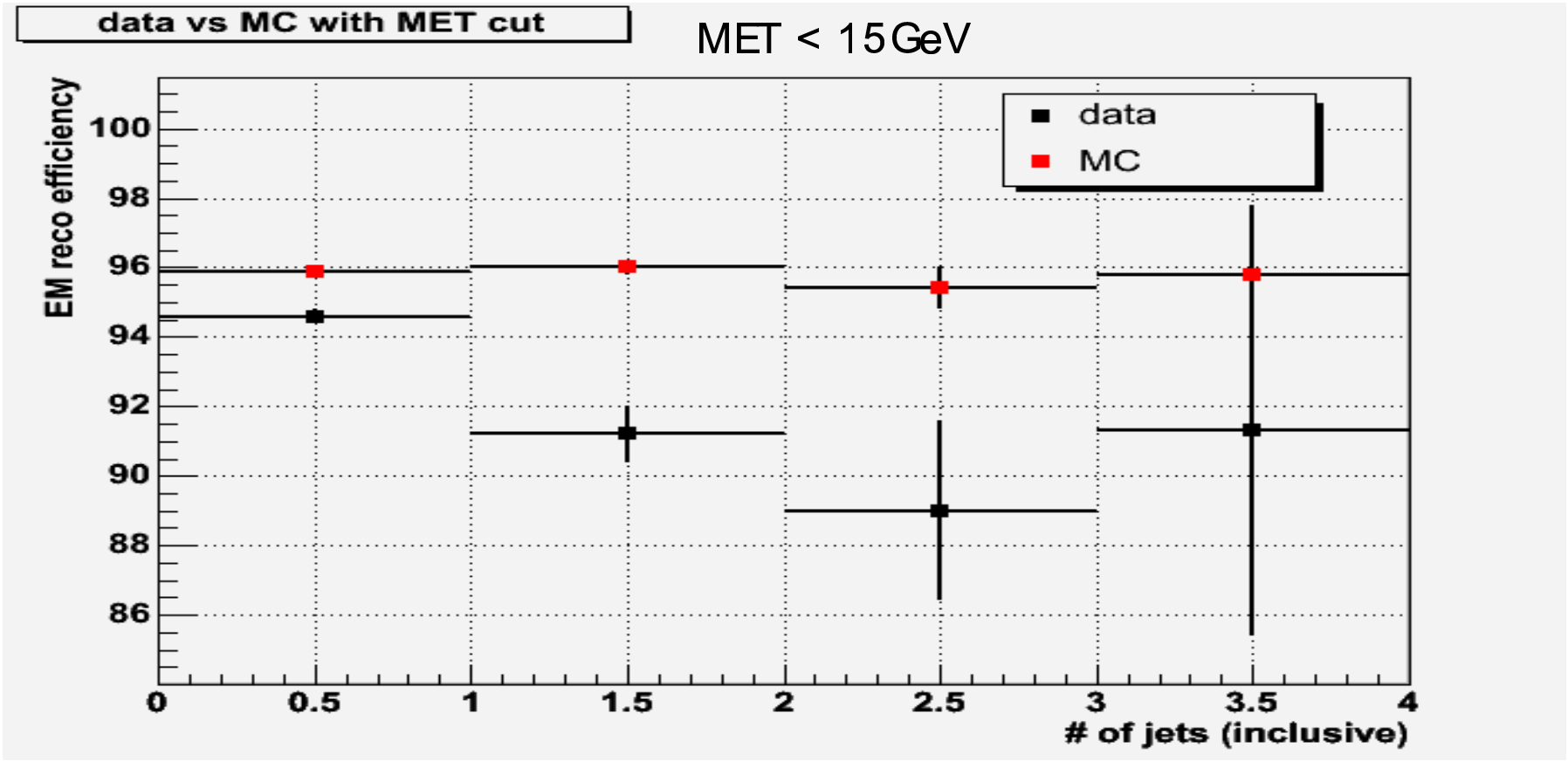




More MET in events w/o reco'd EM cluster: W's ?

Next: cutting on MET (15 GeV)

Comparing data and MC with MET cut



MC is flat now

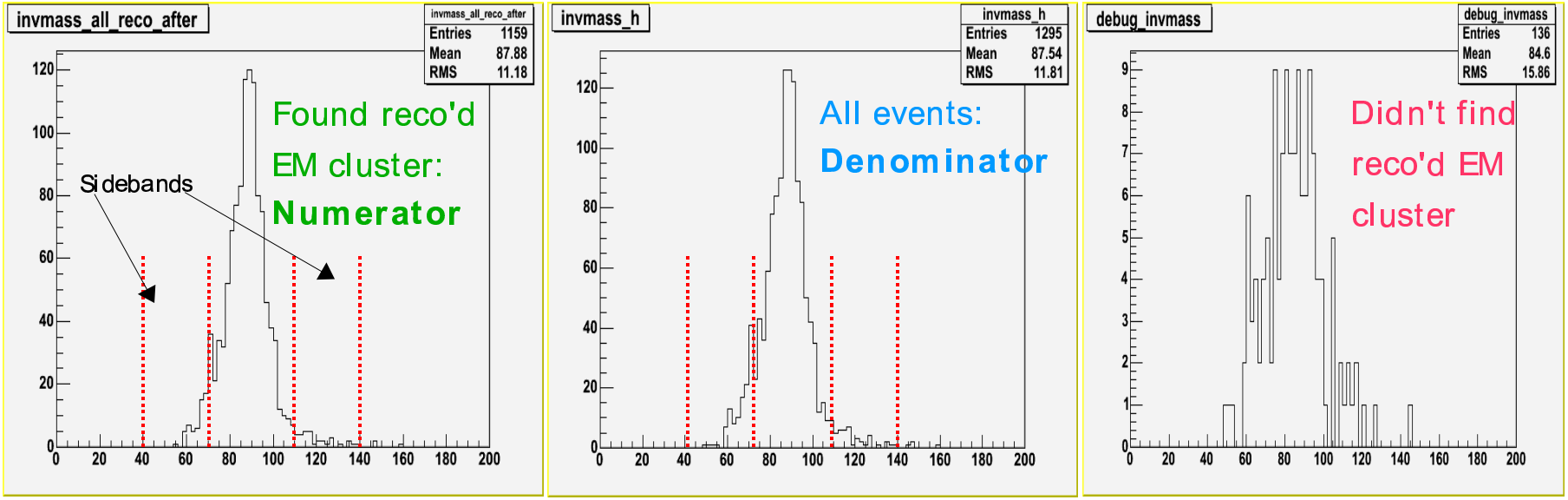
Difference between data and MC gets smaller

Next: add sideband background subtraction

Sideband background subtraction

Trying to further reduce any possible background contamination by estimating background using the diem invariant mass sidebands:

Example for # of jets >= 1 (data)

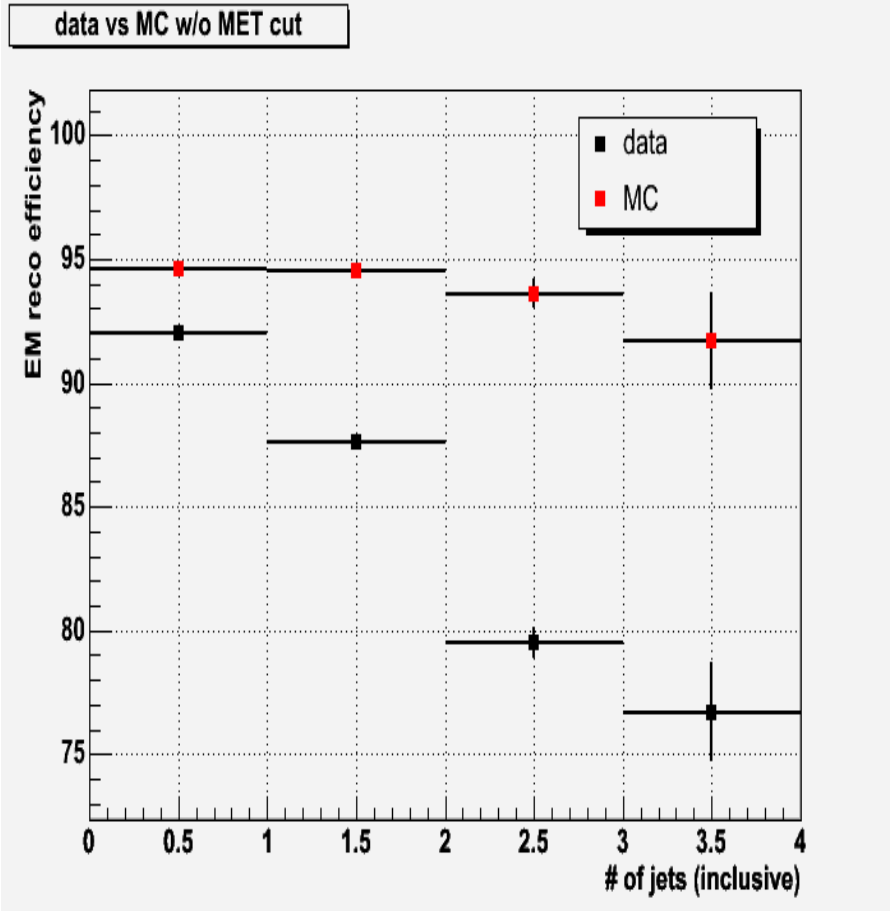


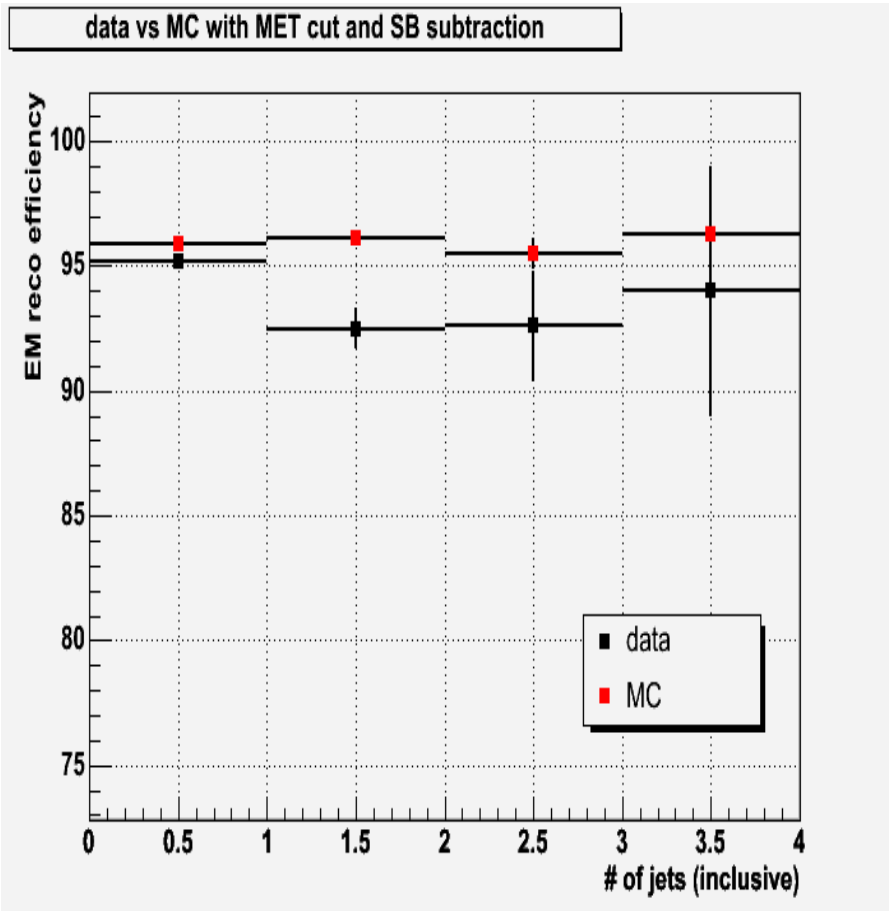
Tag-electron probe-track diem invariant mass histograms [GeV]

EMreco efficiency **before** applying SB bkg subtraction: (91.2 +- 0.8)%

EMreco efficiency **after** applying SB bkg subtraction: (92.5 +- 0.8)%

Sideband background subtraction





Before

After

Residual effect due to phi cracks, background, true jet influence ?

Conclusions and Outlook

- Comparisons with top_analyze: most of discrepancy due to a difference in jet-counting/-removal
- Data vs MC: background is the dominant effect
- Clear improvement and better understanding
- Still need to understand residual effects
- Thanks to Gustavo for very productive input